

REMARKS

Prior to entry of this amendment, claims 1-29 were pending, with claims 19-29 being withdrawn from consideration. This amendment adds new claims 30-50. The requested amendments to the claims do not add any new matter.

The Examiner is thanked for the courtesy of a telephone interview on March 20, 2008. In that interview, proposed amendments to claim 1 and the new claims, in particular claim 30 and the claim now numbered 46, were discussed in view of the Zhou and Kriesel references.

The Amendments to the Claims

Claim 1 has been amended to clarify that the nanostructured material is a silicon-germanium alloy or an alkali metal alloy of this silicon-germanium alloy. This amendment is believed to be supported by paragraphs 46 and 47 of the specification as filed. Claim 1 has also been amended to specify that in the formula $\text{Si}_{(1-z)}\text{Ge}_z$, z is greater than zero and less than one. This amendment is believed to be supported by paragraphs 21-24 of the specification as filed.

New claim 30 recites an electrode for a secondary electrochemical cell comprising a nanofilm of germanium or a germanium alkali metal alloy, the nanofilm thickness being not greater than about 500 nm. This claim is believed to be supported by original claims 1, 7, and 8.

New claims 31 and 32 depend from claim 30 and specify various nanofilm thicknesses. These claims are believed to be supported by original claims 1, 7, and 9 and 1, 7, and 10, respectively.

New claim 33 depends from claim 30 and specifies that the alkali metal alloy is a lithium alloy. This claim is believed to be supported by original claims 1, 2, 7 and 8.

New claim 34 depends from claim 30 and specifies that the electrode comprises a contiguous germanium nanofilm. This limitation is believed to be supported by paragraph 73 of the specification as filed.

New claim 35 depends from claim 30 and specifies that the electrode comprises a germanium-alkali metal alloy produced by electrochemically alloying an alkali metal with a contiguous germanium nanofilm. This limitation is believed to be supported by paragraphs 14 and 73 of the specification as filed.

New claim 36 depends from claim 30 and specifies that the electrode further comprises a conductive diluent. This limitation is believed to be supported by paragraphs 61-62 of the specification as filed.

New claim 37 depends from claim 36 and specifies that the electrode further comprises a current collector. This limitation is believed to be supported by paragraph 61 of the application as filed.

New claim 38 depends from claim 36 and specifies that the electrode comprises alternating layers of germanium nanofilms and conductive diluent. This limitation is believed to be supported by paragraph 62 of the specification as filed.

New claim 39 depends from new claim 36 and specifies that the conductive diluent is capable of binding or alloying with an alkali metal. This limitation is believed to be supported by paragraph 61 of the specification as filed.

New claim 40 is depends from claim 39 and specifies that the alkali metal is lithium. This limitation is believed to be supported by paragraph 61 of the specification as filed.

New claim 41 depends from claim 7 and specifies that the electrode comprises a contiguous silicon-germanium nanofilm. This limitation is believed to be supported by paragraphs 91 and 73 of the specification as filed.

New claim 42 depends from claim 7 and specifies that the electrode comprises a silicon-germanium-alkali metal alloy produced by electrochemically alloying an alkali metal with a contiguous silicon-germanium nanofilm. This limitation is believed to be supported by paragraphs 14, 73 and 91 of the specification as filed.

New claim 43 depends from claim 1 and specifies that the electrode further comprises a conductive diluent. This limitation is believed to be supported by paragraphs 61-62 of the specification as filed.

New claim 44 depends from claim 43 and specifies that the conductive diluent is capable of binding or alloying with an alkali metal. This limitation is believed to be supported by paragraph 61 of the specification as filed.

New claim 45 depends from claim 43 and specifies that the alkali metal is lithium. This limitation is believed to be supported by paragraph 61 of the specification as filed.

New claim 46 specifies that the electrode comprises a nanostructured material and a conductive diluent, wherein the nanostructured material comprises a germanium or germanium alkali metal alloy nanoparticle. This claim is believed to be supported by paragraphs 61-62 of the specification as filed.

New claim 47 depends from claim 46 and specifies that the electrode further comprises a current collector. This limitation is believed to be supported by paragraph 61 of the application as filed.

New claim 48 depends from claim 46 and specifies that the electrode comprises alternating layers of germanium nanoparticles and conductive diluent. This limitation is believed to be supported by paragraph 62 of the specification as filed.

New claim 49 depends from claim 46 and specifies that the conductive diluent is capable of binding or alloying with an alkali metal. This limitation is believed to be supported by paragraph 61 of the specification as filed.

New claim 50 depends from claim 49 and specifies that the alkali metal is lithium. This limitation is believed to be supported by paragraph 61 of the specification as filed.

It is believed that no new matter has been added by any of the amendments requested with this response.

The Rejections under 35 U.S.C. 102(b)

Claims 1-7 and 13-18 were rejected under 35 U.S.C. 102(b) as being anticipated by WO 01/96847, hereinafter referred to as Zhou.

Amended claim 1 relates to electrodes which comprise nanostructured **silicon-germanium alloy** materials or alkali metal alloys thereof. The silicon-germanium materials have the formula $\text{Si}_{(1-z)}\text{Ge}_z$, where z is greater than zero and less than one.

Zhou describes materials incorporating a nanostructure; the specific nanostructure shapes described by Zhou are spherical particles or rod/wire shapes having nanometer-scale dimensions (page 5, lines 1-3 and claim 3). At page 4, lines 20-22, Zhou lists several specific nanostructure compositions: silicon (Si), germanium (Ge), aluminum (Al), silicon oxide and germanium oxide. Applicants note that Zhou does not appear to describe silicon-germanium alloy nanostructures. Since Zhou does not teach a nanostructure which combines silicon and germanium as an alloy or solid solution, Applicants respectfully submit that Zhou fails to teach all the limitations of amended claim 1. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 1. Claims 2-7 and 13-18 depend from and incorporate all the limitations of claim 1. Therefore, Applicants also request reconsideration and withdrawal of the rejections of claims 2-7 and 13-18.

The Rejections under 35 U.S.C. 103

Claims 7-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou in view of U.S. Pre-Grant Publication No. 2004/0106741, hereinafter referred to as Kriesel.

Zhou describes solution deposition of a coating of his nanostructure materials (page 6, lines 6-7); the coatings are of unspecified thickness. Zhou's coatings are made by combining many nanostructures by a technique in which each nanoparticle remains distinct. As previously noted, the scope of teaching in Zhou appears to be limited to materials having discrete silicon and germanium nanostructure domains and, therefore, does not appear to extend to silicon-germanium alloy nanostructures.

Kriesel describes thin layer compositions which are nanofilms prepared from various macrocyclic module components and various polymeric and amphiphilic components (paragraph 2). Therefore, Kriesel's films differ in composition from the alloy nanofilms referred to in claims 7-10 (Ge-Si or Ge-Si-

alkali metal alloys). Although Kriesel teaches methods suitable for the formation of films of various combinations of macrocyclic module, polymeric and amphiphilic components (e.g. paragraphs 110,119, 163, 218 and 219), Applicants respectfully submit that these methods are not generally suitable for formation of the metal or alloy nanofilms of the present invention.

Applicants submit that the combination of Kriesel and Zhou does not teach or suggest the nanofilms of the invention. In particular, the combination of Kriesel and Zhou does not teach the Ge-Si or Ge-Si-alkali metal alloy nanofilms of claim 7 or the particular metal alloy film thicknesses of claims 8-10. Applicants also note that claims 7-10 depend from claim 1, which is believed to be in condition for allowance. In view of all the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejections of claims 7-10.

Claims 11 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou in view of US 4,346,152, hereinafter referred to as Sammels.

The disclosure in Sammels et al. relates to lithium containing electrodes for secondary electrical storage batteries which are characterized as providing morphological and chemical stability upon cell cycling. The scope of disclosure in this reference appears limited, however, to bulk materials of lithium – germanium binary alloys and lithium – germanium - silicon ternary alloys. In contrast to the present invention, there is no teaching or suggestion of nanostructured electrode materials, such as the nanostructured silicon-germanium alloys and alkali metal alloys thereof of the rejected claims. While the Office Action asserts that it would be obvious to include the alloy formulas of Sammels in Zhou in order to provide a secondary electrochemical cell electrode having improved stability, Applicants believe this combination is improper and deficient as used in the pending rejections.

The properties of many nanostructured materials differ significantly from those of bulk materials of the same composition, including properties critical to electrode functionality such as mechanical and electronic properties. Applicants assert, therefore, that it is not predictable that the advantages of the bulk materials disclosed in Sammels would correspond to a nanostructured form of the same material, and there would not be a motivation or suggestion to combine the teaching of these references absent the impermissible use of hindsight. Further, Applicants reiterate that the compositions in Zhou appear to be limited to materials having discrete silicon and germanium nanostructure domains. Therefore, Applicants respectfully assert that the teaching in this reference, alone or in combination with Sammels, does not teach, enable or suggest silicon-germanium alloy nanostructures. Applicants respectfully submit that Zhou and Sammels do not render obvious the rejected claims, as this combination of references does not provide adequate teaching for one of skill in the art to arrive at the invention as claimed. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 11 and 12.

The New Claims

Claim 30 relates to electrodes comprising germanium nanofilms or alkali metal alloys thereof. The thickness of these nanofilms is less than 500 nm. The cited references, either singly or in combination, are not believed to teach or suggest the nanofilms of the invention. Therefore, claim 30 is believed to be patentable over the references of record. Since claims 31-40 depend from and incorporate all the limitations of claim 30, claims 31-40 are also believed to be in condition for allowance. In addition, claims 33-40 contain additional limitations which are believed not to be taught by the combination of the references cited.

Claims 41-42 depend from and incorporate all the limitations of amended claim 7, which is believed to be in condition for allowance. Therefore, claims 41-42 are also believed to be in condition for allowance.

Claims 43-45 depend from and incorporate all the limitations of amended claim 1, which is believed to be in condition for allowance. Therefore, claims 43-45 are believed to be in condition for allowance.

Claim 46 relates to an electrode comprising a nanostructured material and a conductive diluent, wherein the nanostructured material comprises a germanium or germanium alkali metal alloy nanoparticle. The cited references, either singly or in combination, are not believed to teach or suggest the invention of claim 46. Since claims 47-50 depend from and incorporate all the limitations of claim 46, claims 47-50 are also believed to be in condition for allowance.

Summary

Applicants assert that all claims are in condition for allowance, and therefore, passage to issuance is respectfully requested.

It is believed that a fee of \$915, for the addition of two independent claims (\$210) and nineteen dependent claims (\$475), and for the payment of a 2-month extension of time (\$230) is due with this submission. If this is incorrect, please charge any deficiency or credit any overpayment to deposit account 07-1969.

Respectfully submitted.

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